Plasmaspheric Total Densities

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Because of spacecraft charge, the plasma density measured from spacecraft by particle and wave instruments can be different. The wave measurement derived densities are obtained in such a way that they are not affected by spacecraft charge but they can not always measure composition as can the particle instruments. Each instrument type has its own advantages and limitations. By using both types of instrumentation, more can be learned about the Earth's plasma environment and in some cases, the spacecraft response to the ambient environment. At MSFC, we are taking advantage of the data from the plasma wave instrument (PWI) and the retarding ion mass spectrometer (RIMS) on Dynamics Explorer 1 to explore and expand our understanding of the plasma in the inner magnetosphere. PWI data in the form of total electron densities are being supplied to MSFC by the University of Iowa (the home institution of the PWI principle investigator, Dr. D. Gurnett). Investigators at MSFC and the University of Iowa are cooperating in a study of the plasma-spheric response to geomagnetic and solar input and in an attempt to build a data base on which a global model of the total plasma density can be based. The global model can then be used in space weather applications or in other studies that support future mission such as those that have the purpose of obtaining data on a global scale.

The first step in this study is the examination of the of the plasma density in thew plasmasphere, and that is the purpose of the cooperative effort between MSFC and the University of Iowa. The plasmasphere is a doughnut-shaped area centered on the Earth that contains cold dense plasma. Figure 176 shows a small sampling of the data from PWI in the form of density as a function of the McIlwain L parameter, a parameter related to the ambient magnetic field. Notice the sharp decrease in the density near L=5. This is the plasmapause and marks the outer edge of the plasmasphere. The position and shape of the plasmapause changes in response to the geophysical environment so that the decrease covers a rather wide range of L values in figure 176. We are presently enlarging the data base of these profiles. When completed, the data base will contain multiple years of data, to which RIMS particle observations can be added to give information on the energy, mass composition, and spatial extent of the plasma.

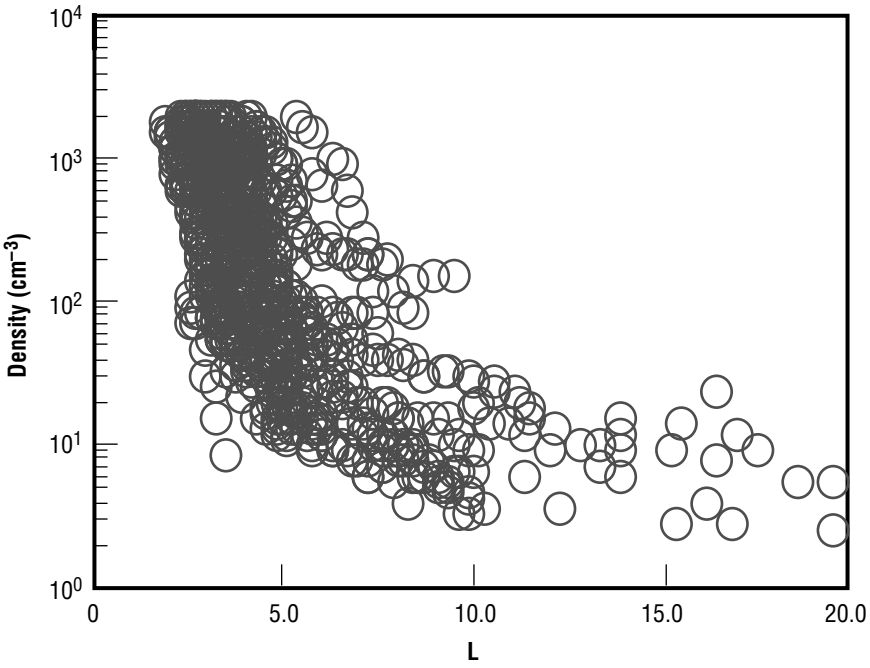

Figure 176.—Density derived from wave measurements as a function of the McIlwain L parameter.

Sponsor: Office Of Space Science

University Involvement: Dr. Douglas Menietti and Chris Piker at the University of Iowa; Dr. R. H. Comfort at the University of Alabama in Huntsville/Center for Space Plasma and Aeronomy Research.

Biographical Sketch: Dr. Paul Craven has been involved with the analysis of data from the RIMS instrument analysis and is presently working with the thermal ion dynamics experiment instrument on the polar spacecraft. Craven's research interests include the source, transport , and energization of the magnetospheric ions. He received his Ph.D. in physics from the University of Alabama in Huntsville in 1993.